

WHAT IS CLAIMED IS:

1. An electrochemical cell comprising an open ended cylindrical housing and an end cap assembly inserted therein closing said housing, said end cap assembly comprising a support disk comprising metal and an underlying electrically insulating sealing disk when the cell is viewed in vertical position with the end cap assembly on top, wherein said support disk has a downwardly extended surface, said downwardly extended surface extending downwardly from a high point thereon to low point thereon, said downwardly extended surface being slanted so that said high point is closer to the cell's central longitudinal axis than said low point when the cell is viewed in vertical position with the end cap assembly on top, said downwardly extended surface not being parallel to the cell's central longitudinal axis, said downwardly extended surface having at least one aperture therethrough, wherein said sealing disk has a downwardly extending wall abutting said downwardly extended surface of said support disk on the side thereof facing the cell interior, wherein said abutting wall of said sealing disk has a groove on its inside surface facing the cell interior, said groove forming a rupturable membrane abutting said aperture, whereby when gas pressure within the cell rises, said rupturable membrane penetrates through said aperture and ruptures thereby releasing gas into the surrounding environment through said aperture.

2. The cell of claim 1 wherein said downwardly extended surface of said support disk is slanted at an angle of between 40 and 80 degrees from the cell's central longitudinal axis.

3. The cell of claim 1 wherein said housing comprises steel and said housing has a wall thickness of between 4 and 8 mils (0.10 and 0.20 mm).

4. The cell of claim 1 wherein the portion of downwardly extending wall of said sealing disk immediately adjacent said groove has a thickness greater than said rupturable membrane, wherein the ratio of thickness of the rupturable membrane formed by said groove to the thickness of said downwardly extending wall immediately adjacent said groove is less than $1/2$.

5. The cell of claim 1 wherein the portion of downwardly extending wall of said sealing disk immediately adjacent said groove has a thickness greater than said rupturable membrane, wherein the ratio of thickness of the rupturable membrane formed by said groove to the thickness of said downwardly extending wall immediately adjacent said groove is between $1/2$ and $1/10$.

6. The cell of claim 1 wherein the thickness of said rupturable membrane formed by said groove is between about 0.08 and 0.15 mm.

7. The cell of claim 1 wherein said aperture in said support has an area between 7 and 60 mm².

8. In an electrochemical cell having an open ended cylindrical housing and an end cap assembly inserted therein closing said housing, said cell having a positive and a negative terminal, said end cap assembly comprising an electrically insulating sealing disk, said insulating sealing disk having an elongated electrically conductive current collector passing therethrough, the current collector being in electrical contact with a cell terminal, the improvement comprising:

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the end cap assembly comprising a support disk comprising metal, and the insulating sealing disk underlying said support disk when the cell is viewed in vertical position with the end cap assembly on top, wherein said insulating disk electrically insulates the support disk from the cell housing; said support disk being of single piece metallic construction having a convoluted surface and at least one aperture therethrough; said insulating disk having a convoluted surface wherein a portion of its surface underlies said aperture in said support disk when the cell is viewed in vertical position with the end cap assembly on top, said portion of said insulating disk underlying said aperture having a groove on a side of its surface facing the cell interior, said groove having an open end and opposing closed base wherein the base of said groove forms a thinned rupturable membrane abutting said aperture in said support disk, whereby when gas pressure within the cell rises, said rupturable membrane penetrates through said aperture and ruptures thereby releasing gas into the surrounding environment through said aperture.

9. The electrochemical cell of claim 8 wherein said groove on said insulating disk surface circumvents the center of said sealing disk.

10. The electrochemical cell of claim 8 wherein said rupturable membrane formed by said groove has a width to thickness ratio of between about 2.5 and 12.5.

11. The electrochemical cell of claim 10 wherein said groove on said insulating disk surface has a width of between about 0.1 and 1 mm.

12. The electrochemical cell of claim 8 wherein the housing comprises steel and said housing has a wall thickness between 4 and 8 mils (0.10 and 0.20 mm).

13. The electrochemical cell of claim 8 wherein a portion of the insulating disk contacts said support disk in the region of a surface of said support disk immediately adjacent said aperture.

14. The electrochemical cell of claim 8 wherein said insulating disk comprises a plastic material having a downwardly extending surface slanted at an angle less than 90 degrees from the cell's central longitudinal axis and not parallel to said longitudinal axis, said downwardly extending surface of said insulating disk extends downwardly from a high point thereon to low point thereon, said high point being closer to the cell's central longitudinal axis than said low point when the cell is viewed in vertical position with the end cap assembly on top, wherein said support disk has a downwardly extending surface slanted at an angle less than 90 degrees from the cell's central longitudinal axis and not parallel to said longitudinal axis, said downwardly extending surface of the support disk extends downwardly from a high point thereon to low point thereon, said high point being closer to the cell's central longitudinal axis than said low point when the cell is viewed in vertical position with the end cap assembly on top, wherein the downwardly extending surface of the insulating disk underlies at least a substantial portion of the downwardly extending surface of said support disk, wherein said at least one aperture penetrates through said downwardly extending surface of said support disk, wherein a portion of said rupturable membrane underlies and abuts said aperture.

15. The electrochemical cell of claim 14 wherein the downwardly slanted surface of said insulating sealing disk is slanted at an angle of between about 40 and 80 degrees from the cell's central longitudinal axis.

16. The electrochemical cell of claim 14 wherein said downwardly extending surface of said support disk is slanted from the cell's central longitudinal axis at the same angle as said downwardly extending surface of the insulating sealing disk.

17. The electrochemical cell of claim 8 wherein said aperture in said support has an area between about 7 and 16 mm² and said rupturable membrane at the base of said groove has a thickness between about 0.08 and 0.15 mm.

18. The electrochemical cell of claim 8 wherein the end cap assembly further comprises an insulating washer over the support disk and a terminal end cap over said insulating washer, said terminal end cap being welded to the support disk.

19. The electrochemical cell of claim 14 wherein the surface of said support disk has a substantially flat central portion.

20. The electrochemical cell of claim 8 wherein said current collector is welded to said support disk.

21. The electrochemical cell of claim 8 wherein said current collector is welded to said end cap.

22. The electrochemical cell of claim 8 wherein support disk has a pair of opposing apertures in the downwardly extending surface of said disk.

23. The electrochemical cell of claim 14 wherein the support disk has a peripheral outer edge and a substantially flat central portion, wherein said central portion is at right angle to the cell's central longitudinal axis and said downwardly extending surface of the support disk extends downwardly from said central portion to said peripheral outer edge.

24. The electrochemical cell of claim 23 wherein said central portion of the support disk extends outwardly beyond the edge of the cylindrical housing at the open end thereof, and wherein the peripheral edge of said support disk bites into the peripheral edge of said insulating sealing disk and exerts radial compressive forces on said sealing disk.

25. In an electrochemical cell having an open ended cylindrical housing and an end cap assembly inserted therein closing said housing, said cell having a positive and a negative terminal, said end cap assembly comprising a terminal end cap and an electrically insulating sealing disk, said insulating disk having an elongated electrically conductive current collector passing therethrough and in electrical contact with said terminal end cap, and the edge of said housing being crimped over the peripheral edge of said insulating sealing disk to form a cell shoulder along the line of crimp, the improvement comprising:

the end cap assembly comprising a support disk of single piece metallic construction having a convoluted surface and at least one aperture therethrough, said support disk underlying said terminal end cap and said insulating sealing disk underlying said support disk when the cell is viewed in vertical position with the end cap assembly on top, wherein the insulating disk electrically insulates said support disk from the cell housing; said

insulating disk having a downwardly extended wall extending downwardly towards the cell interior and not parallel to the cell's central longitudinal axis, said downwardly extending wall of said insulating sealing disk slanted downwardly from a high point thereon to low point thereon, said high point being closer to the cell's central longitudinal axis than said low point when the cell is viewed in vertical position with the end cap assembly on top, wherein a portion of said downwardly extending wall of the insulating disk underlies said aperture in said support disk when the cell is viewed in vertical position with the end cap assembly on top, said portion of said downwardly extending wall of said insulating disk having a groove on a side thereof facing the cell interior, said groove having an open end and opposing closed base, wherein the base of said groove forms a thinned rupturable membrane abutting said aperture in said support disk, whereby when gas pressure within the cell rises said rupturable membrane penetrates through said aperture and ruptures thereby releasing gas into the surrounding environment through said aperture.

26. The electrochemical cell of claim 25 wherein said groove on said downwardly extending wall of said insulating disk circumvents the center of said insulating disk.

27. The electrochemical cell of claim 25 wherein said rupturable membrane formed by said groove has a width to thickness ratio of 2.5 to 12.5.

28. The cell of claim 25 wherein the portion of downwardly extending wall of said sealing disk immediately adjacent said groove has a thickness greater than said rupturable membrane, wherein the ratio of thickness of the rupturable membrane formed by said groove to the thickness

of said downwardly extending wall immediately adjacent said groove is between $1/2$ and $1/10$.

29. The electrochemical cell of claim 25 wherein said aperture in said support has an area between about 7 and 16 mm² and said rupturable membrane at the base of said groove has a thickness between about 0.08 and 0.15 mm.

30. The electrochemical cell of claim 25 wherein the housing comprises steel and said housing has a wall thickness between 4 and 8 mils (0.10 and 0.20 mm).

31. The electrochemical cell of claim 25 wherein a portion of said downwardly extending wall of said insulating disk contacts said support disk in the region of a surface of said support disk immediately adjacent said aperture.

32. The electrochemical cell of claim 25 wherein said insulating disk comprises a plastic material and said downwardly extending surface of said insulating disk is slanted at an angle between about 40 and 80 degrees from the cell's central longitudinal axis.

33. The electrochemical cell of claim 25 wherein said support disk has a downwardly extending surface extending downwardly towards the cell interior and not parallel to the cell's central longitudinal axis, said downwardly extending surface of said support disk extends downwardly from a high point thereon to a low point thereon, said high point being closer to the cell's central longitudinal axis than said low point when the cell is viewed in vertical position with the support disk on top, wherein the downwardly extending surface of the insulating disk

underlies and abuts at least a substantial portion of said downwardly extending surface of the support disk.

34. The electrochemical cell of claim 25 wherein said groove forming said rupturable membrane is made by pressing a cutting die onto the side of said downwardly extending wall of the sealing disk facing the cell interior.

35. The electrochemical cell of claim 34 wherein the width of the rupturable membrane is between about 0.08 and 1.0 mm.

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